



An Energy Efficiency Workshop & Exposition

Palm Springs, California

*A Sustainable Facility  
for a Sustainable Agency*

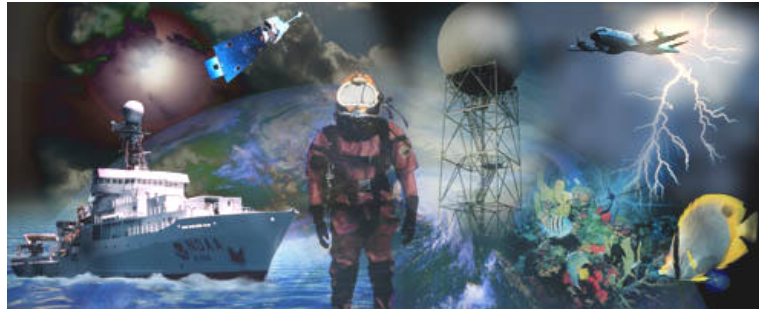
Robert J. Gries, P.E., CCM, PMP



## *NOAA's Mission*

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To describe and predict changes in the Earth's environment, and conserve and wisely manage the Nation's coastal and marine resources





## *Need for the Project*

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- ❑ Inadequate facility to support legislatively mandated fisheries management
- ❑ Relieve overcrowding and accommodate approved project growth
- ❑ Interrelated functions need to be consolidated to optimize performance
- ❑ Not compliant with ADA or UFAS requirements or current building codes



## *Site Constraints*

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June 2-5, 2002

[www.energy2002.ee.doe.gov](http://www.energy2002.ee.doe.gov)





## *Initial Concept Design*



June 2-5, 2002

[www.energy2002.ee.doe.gov](http://www.energy2002.ee.doe.gov)



## *Organizational Challenges*

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- ❑ Management's unfamiliarity with various Executive Orders, design concepts, etc.
- ❑ Concerns regarding increased project costs with limited, if any, benefits
- ❑ No funding to support/evaluate initiatives (*except at DOC level*)
- ❑ Misperceptions about lack of quality control if implemented



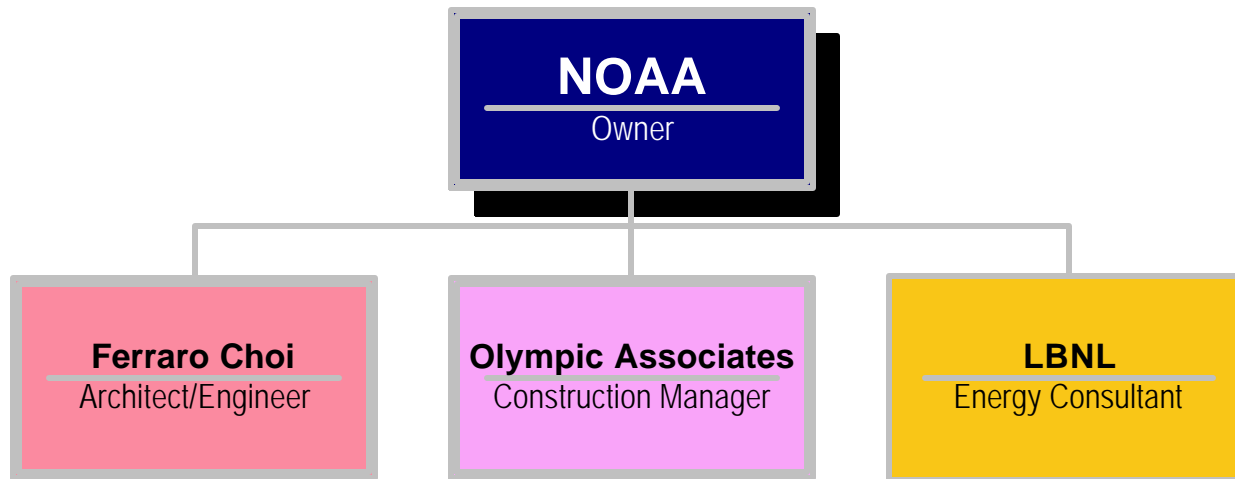
## *Design Phase Objectives*

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- Definition of “World Class Facility” & how it can be accomplished within the established budget
- Degree of incorporating Sustainable Design, i.e., LEED Building Gold™ rating
- Development & implementation of an energy budget for design
- Degree of specifying Energy Star® equipment and materials



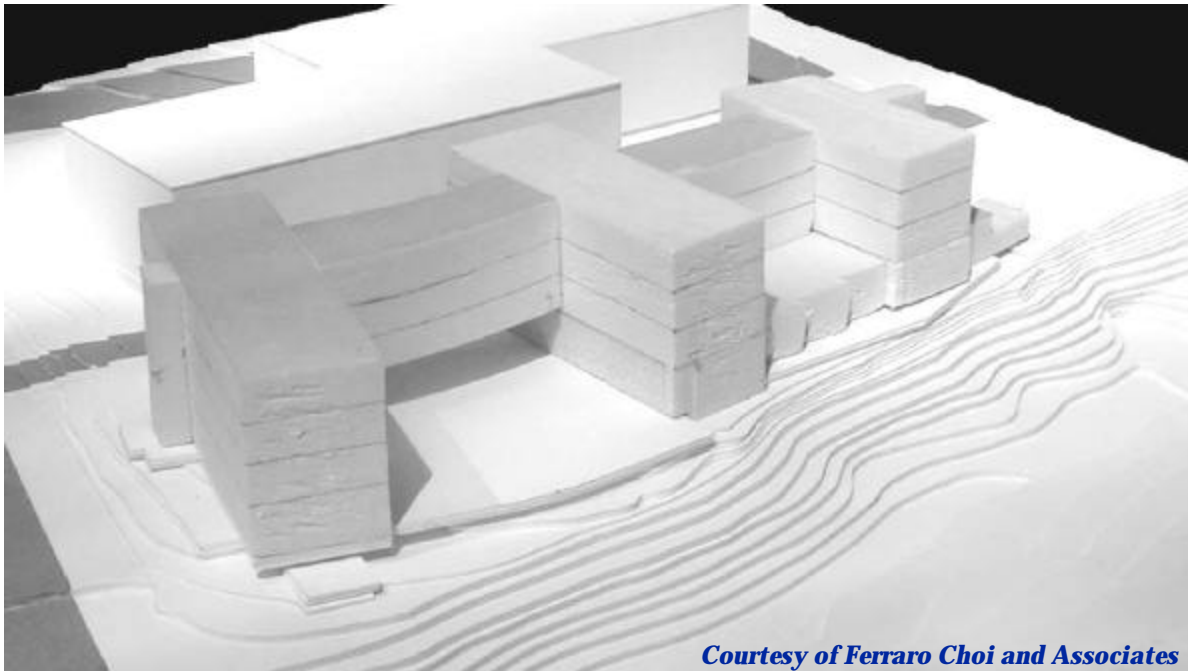
## *HLRP Team*





## *Concept Modeling*

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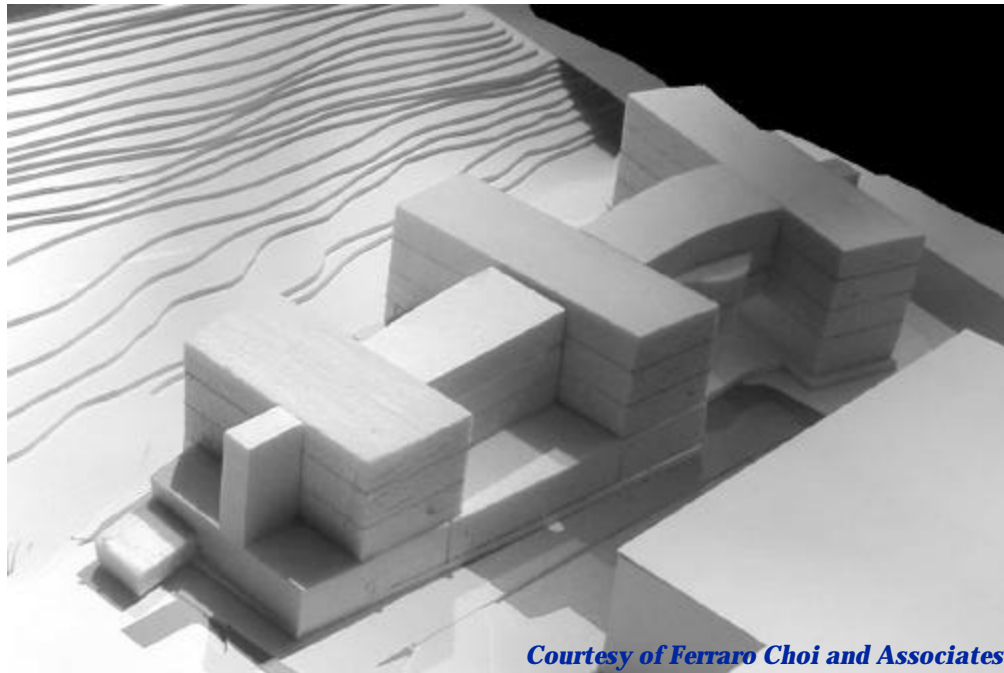


*Courtesy of Ferraro Choi and Associates*



## *Concept Modeling*

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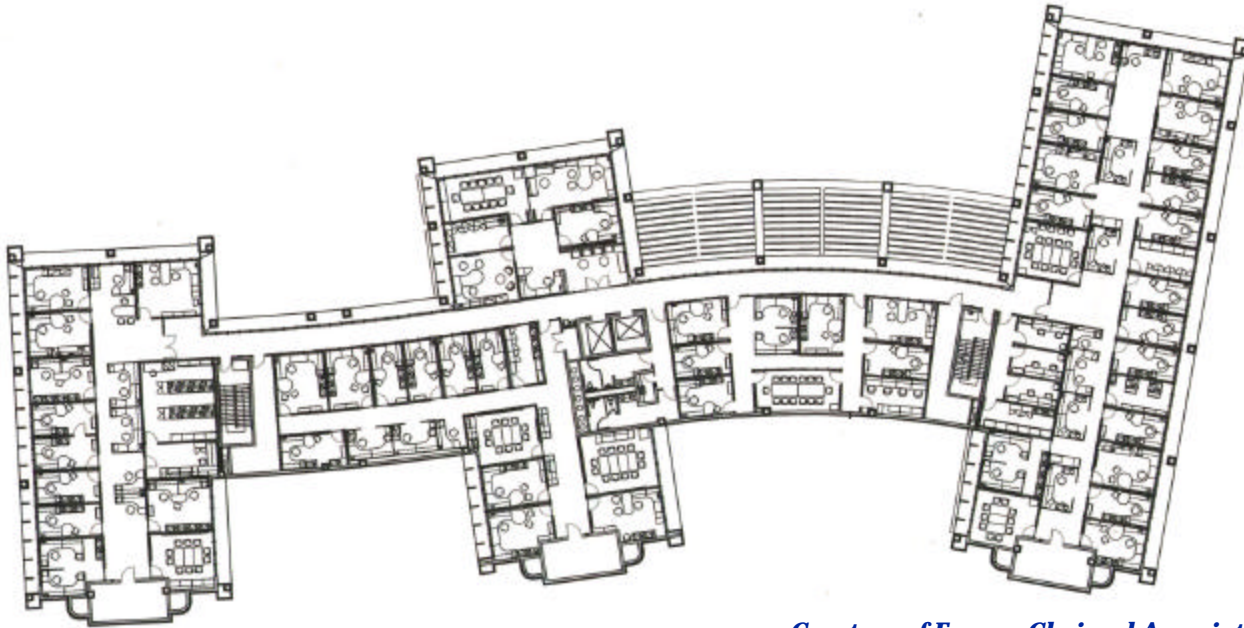


*Courtesy of Ferraro Choi and Associates*



## *Typical Floor Plan Concept*

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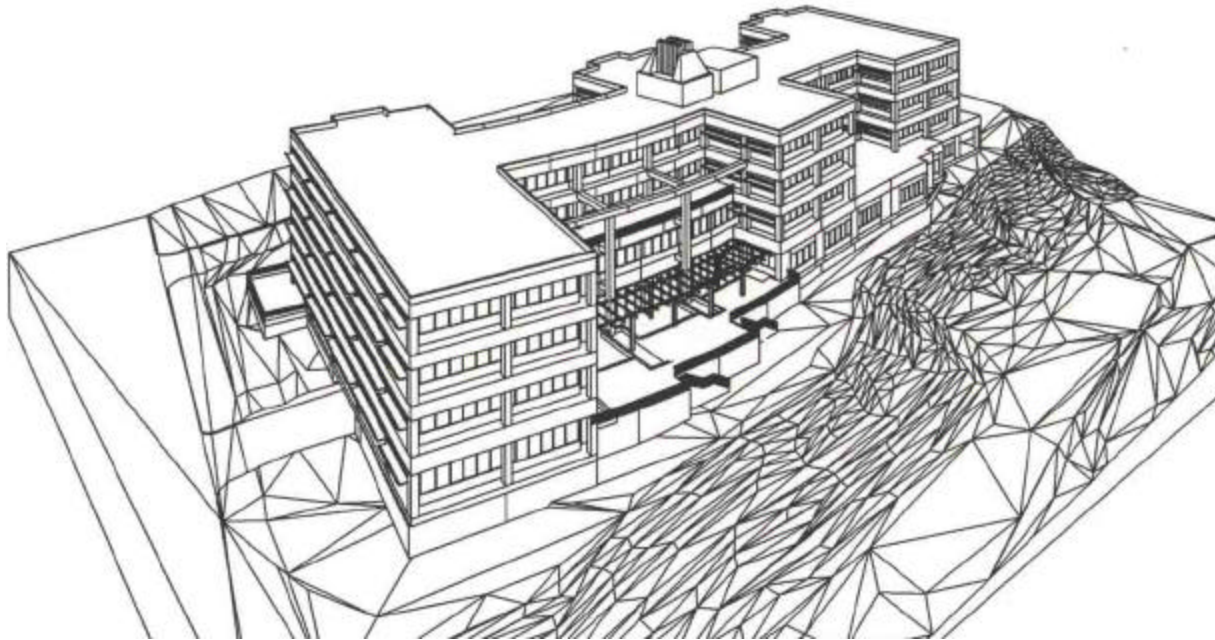
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## *Envelope Development – East*

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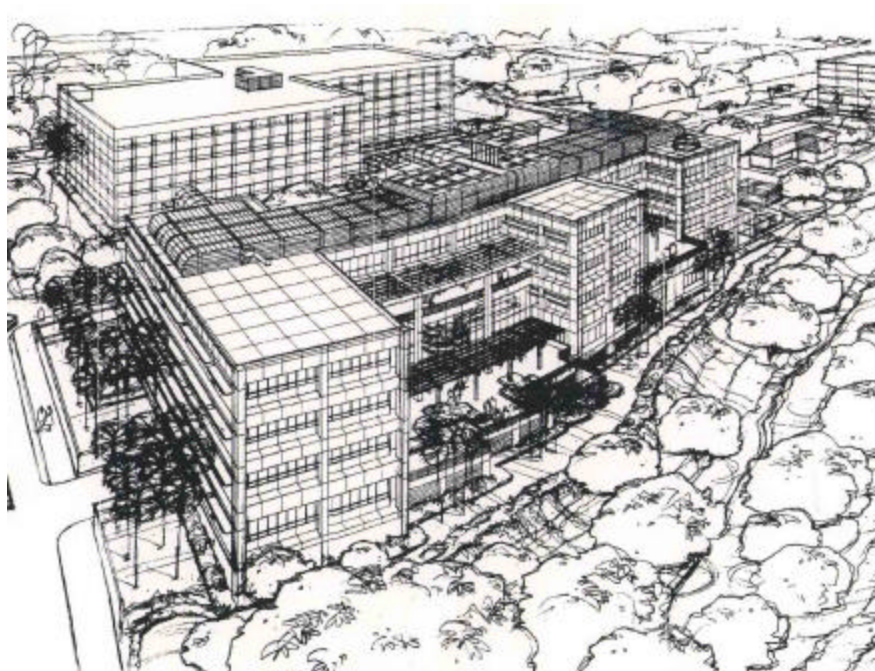
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## *Envelope Development – East*

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13



## *Final Design – East*

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14



## *100% Synergy of Design*

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### **Electrical**

- ❑ One Voltage System
- ❑ Daylighting
- ❑ Lumen Package
- ❑ Appliance Loads

### **Air Conditioning**

- ❑ Radiant Cooling
- ❑ Higher Chilled Water Temperatures
- ❑ Dessicant Dehumidification
- ❑ Solar Regeneration
- ❑ 100% Outside Air
- ❑ Energy Recovery



## *Electrical Engineering*

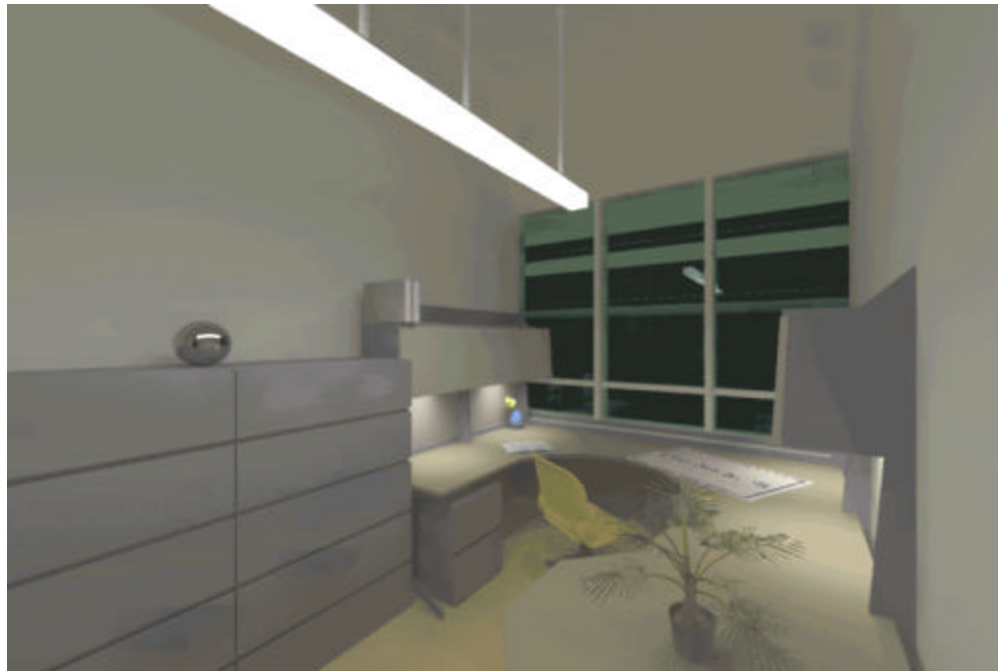
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- Ambient/Task Lighting
- International Lighting Standards
- Lighting Control
- Lumen/Lamp Package
- Single Voltage System
- Modular Wiring



## *Daylight Modeling*

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*Courtesy of Lincoln Scott*

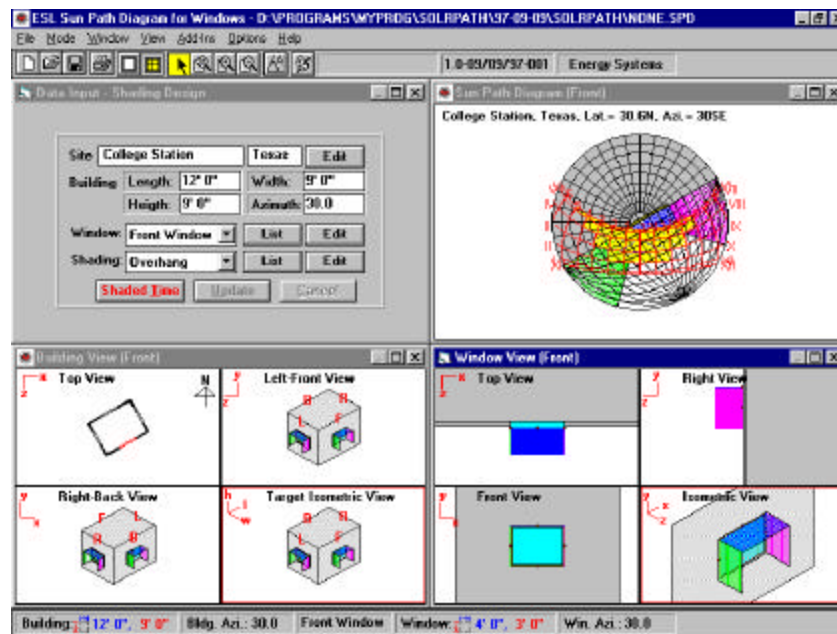
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17



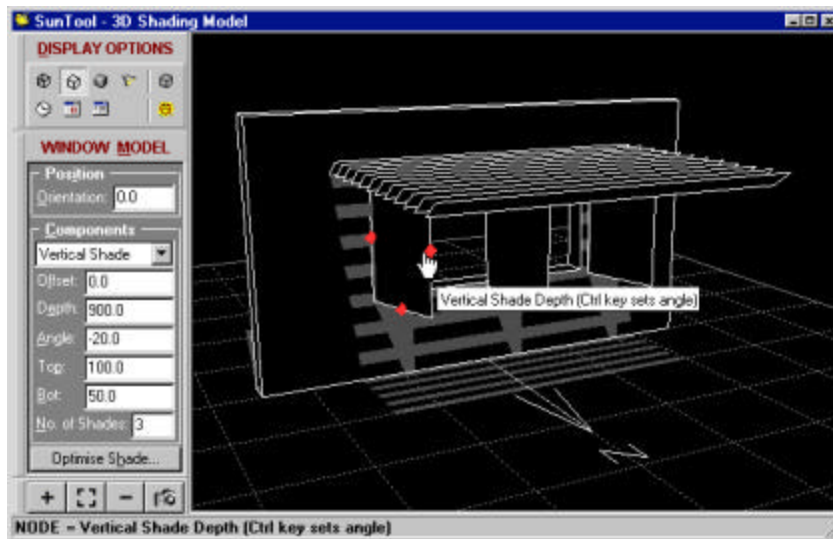
## Solar Orientation



- Graphical representation of the solar path and its relation to the orientation of a window or shading device
- SolrPath: Windows based program developed by the Energy Systems Laboratory at Texas A&M University



## Shade Modeling

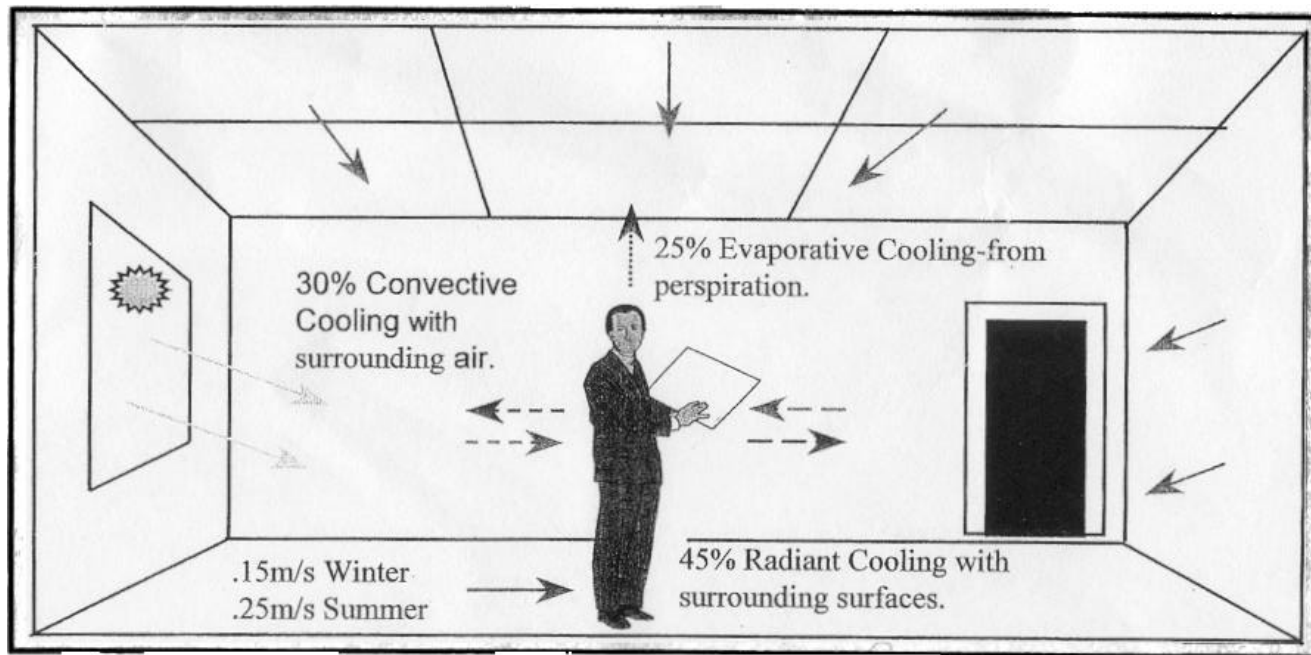


- Interactive shading design
- Accurately size and position overhangs, shading devices and louvers easily
- Suntect: Windows based program (now *The Solar Tool*) developed by Dr. Andrew Marsh





## Thermal Comfort



*Courtesy of Lincolne Scott*





# Thermal Comfort

**PMVTOOL - © A.J.Marsh '97**

**Predicted Mean Vote** Another shareware product from ESCAPE Consulting (Andrew.Marsh@uwa.edu.au, [http://arch.uwa.edu.edu.au](http://arch.uwa.edu.au))

Esc [Folder] [Floppy] [Bar Chart] [Printer] [Question Mark]

**Predicted Mean Vote: -0.02** **Percentage Dissatisfied: 5.0%**

-3 -2 -1 0 +1 +2 +3

**Cold Cool Neutral Warm Hot**

☒ Air Temperature (°C) **26** ☐ Activity Rate (met) **1.02**

-30 -20 -10 0 10 20 30 0 1 2 3 4

Sedentary activity

☐ Radiant Temperature (°C) **20** ☐ Clothing (clo) **1.03**

-30 -20 -10 0 10 20 30 0 1 2 3

Light business suit

☐ Relative Humidity (%) **55** ☐ Air Velocity (m/s) **0.50**

0 100 0 1 2

Pleasant

Project/Description: Fri Aug 18, 2000  
Typical Example for Forrester Kurts Consideration

Project Number: Prepared/Checked By:  
Effect of radiant temperatures: Lincolne Scott

- Predicted Mean Vote (PMV): thermal scale that calculates the Predicted Percentage of Dissatisfied people (PPD)
- Originally developed by Dr. P. Ole Fanger and later adopted as an ISO standard
- PMVTool: Windows based program (now *The Psycho Tool*) developed by Dr. Andrew Marsh



## *Why Radiant Cooling?*

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- ❑ No draughts – even in rooms with high heat gains
- ❑ Radiant heat exchange reduces the degree of convective cooling
- ❑ Improved air quality (i.e., 100% outside air)
- ❑ Highest possible human comfort = Improved productivity
- ❑ Reduced noise levels in occupied spaces
- ❑ Substantially reduced maintenance requirements due to absence of moving parts



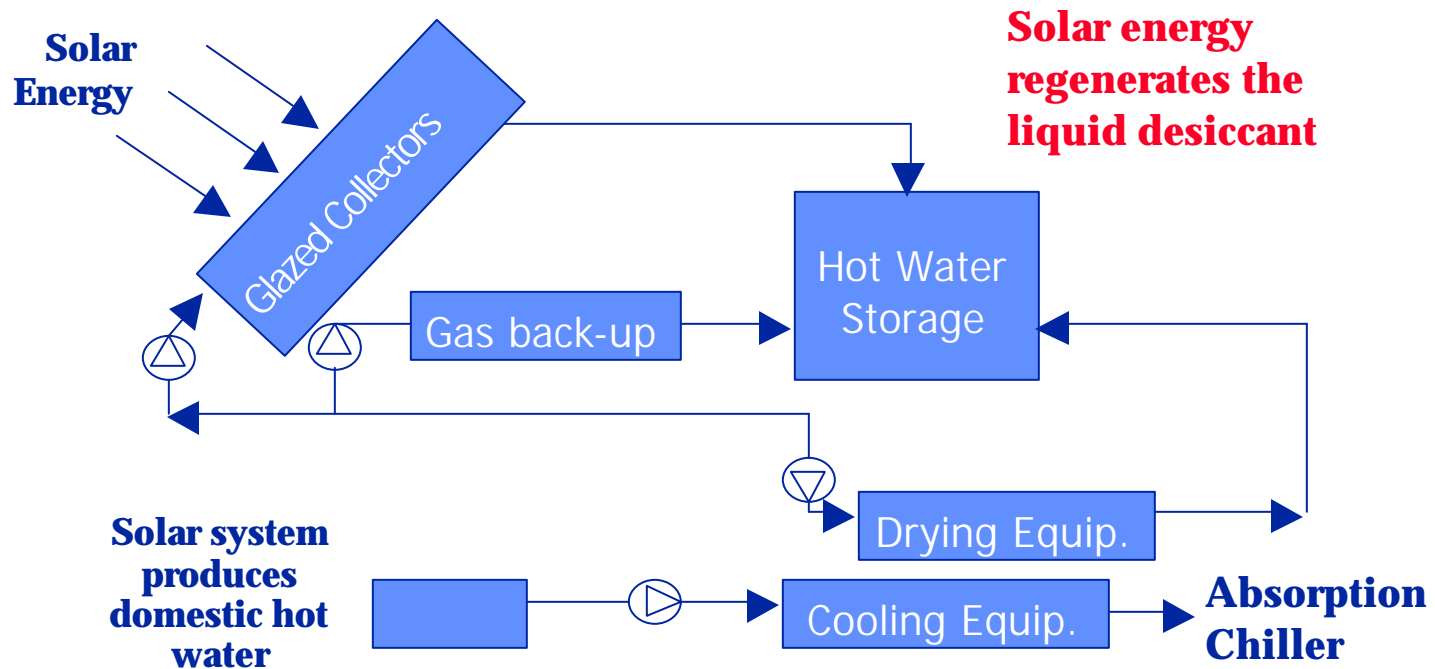
## *Typical Chilled Ceiling Tile*



- Control cooling loads by the use of water instead of air
- Works on principles of both radiation and convection
- More cost effective, clean, and natural indoor climate



## *Dessicant Dehumidification*



*Courtesy of Lincoln Scott*



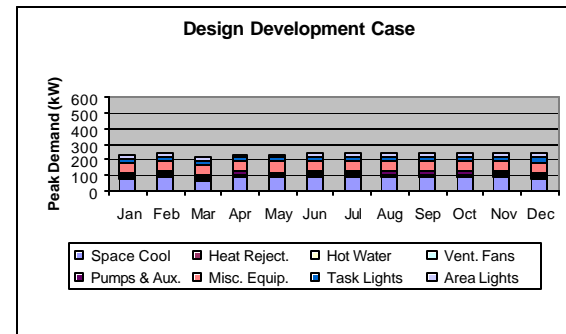
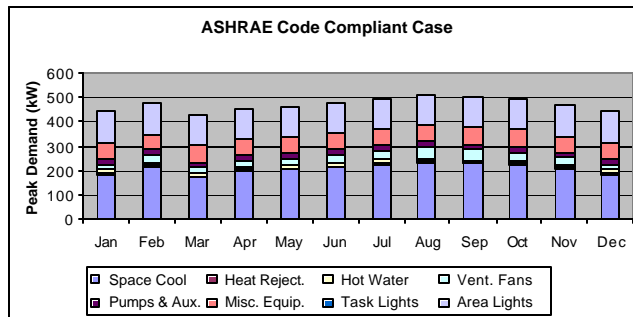
## *Why is it important to low energy design?*

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- ❑ It allows the use of waste heat or solar energy.
- ❑ It allows dehumidification without the wastes of energy employed by conventional systems.
- ❑ It separates relative humidity from temperature and a higher thermal comfort can be achieved.
- ❑ When used effectively, it can result in significant energy and cost savings.



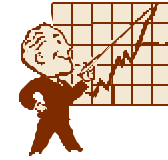
## DOE-2.2 Results



- ASHRAE – 1,156,000 kWh/yr
- Design – 504,000 kWh/yr
- Percent Savings = 44%



## *Results*



- FY 2002 Federal Energy Saver Showcase Award
- Progressing towards the LEED Building Gold™ rating
  - 1<sup>st</sup> federal laboratory
  - 1<sup>st</sup> facility in Hawaii
- Progressing towards Energy Star® building designation
- Potential energy rebates from HECO



## *Lessons Learned*



- ❑ Every project needs a champion
- ❑ Clearly communicate the goals & objectives and obtain sponsor's approval
- ❑ Many obstacles and challenges to overcome – both externally & internally
- ❑ Delayed gratification – aesthetically appealing, energy efficient facility